

WHAT IS CLAIMED IS:

1                   1.       A communication device configured to perform a plurality of  
2 functions, comprising:  
3                   a plurality of heterogeneous computational elements; and  
4                   an interconnection network coupled to the plurality of heterogeneous  
5 computational elements, the interconnection network operative to configure the plurality of  
6 heterogeneous computational elements;  
7                   wherein a first group of heterogeneous computational elements is configurable  
8 to form a first functional unit to implement a system acquisition function;  
9                   wherein a second group of heterogeneous computational elements is  
10 configurable to form a second functional unit to implement a communication function; and  
11                   wherein if the communication function is idle, one or more of the second  
12 group of heterogeneous computational elements are reconfigurable by the interconnection  
13 network to implement the system acquisition function.

1                   2.       The communication device of claim 1 wherein the first functional unit  
2 is a searcher.

1                   3.       The communication device of claim 1 wherein the communication  
2 device is a cellular phone, a Bluetooth communication device or a 802.11 communication  
3 device.

1                   4.       The communication device of claim 1 wherein if the communication  
2 function is idle, the one or more of the second group of heterogeneous computational  
3 elements are reconfigurable to implement the system acquisition function by forming one or  
4 more additional instances of the first functional unit.

1                   5.       The communication device of claim 1 wherein if the communication  
2 function is idle, one or more of the first group of heterogeneous computational elements and  
3 the one or more of the second group of heterogeneous computational elements are  
4 reconfigurable to form a single functional unit to implement the system acquisition function.

1                   6.       The communication device of claim 1 wherein if the communication  
2 function is idle, the one or more of the second group of heterogeneous computational

3 elements are reconfigurable by the interconnection network to implement one or more of the  
4 plurality of functions other than the communication function.

1 7. The communication device of claim 1 wherein if a third function is to  
2 be implemented, one or more of the first group of heterogeneous computational elements  
3 and/or the one or more of the second group of heterogeneous computational elements are  
4 reconfigurable by the interconnection network to implement the third function.

1 8. A communication device comprising:  
2 a plurality of reconfigurable matrices, the plurality of reconfigurable matrices  
3 including a plurality of heterogeneous computational units, each heterogeneous  
4 computational unit having a plurality of fixed computational elements, the plurality of fixed  
5 computational elements including a first computational element having a first architecture  
6 and a second computational element having a second architecture, the first architecture  
7 distinct from the second architecture, the plurality of heterogeneous computational units  
8 coupled to an interconnect network and reconfigurable in response to configuration  
9 information; and

10 a matrix interconnection network coupled to the plurality of reconfigurable  
11 matrices, the matrix interconnection network operative to reconfigure the plurality of  
12 reconfigurable matrices in response to the configuration information for a plurality of  
13 operating modes;

14 wherein a first group of heterogeneous computational units is reconfigurable  
15 to form a first functional unit to implement a system acquisition mode;

16 wherein a second group of heterogeneous computational units is  
17 reconfigurable to form a second functional unit to implement a communication mode;

18 wherein if the communication mode is idle, one or more of the second group  
19 of heterogeneous computational units are reconfigurable to implement the system acquisition  
20 mode.

1 9. The communication device of claim 8 wherein the first functional unit  
2 is a searcher.

1 10. The communication device of claim 8 wherein the communication  
2 device is a cellular phone, a Bluetooth communication device or a 802.11 communication  
3 device.

1           11.     The communication device of claim 8 wherein if the communication  
2 mode is idle, the one or more of the second group of heterogeneous computational units are  
3 reconfigurable to implement the system acquisition mode by forming one or more additional  
4 instances of the first functional unit.

1           12.     The communication device of claim 8 wherein if the communication  
2 mode is idle, one or more of the first group of heterogeneous computational units and the one  
3 or more of the second group of heterogeneous computational units are reconfigurable to form  
4 a single functional unit to implement the system acquisition mode.

1           13.     The communication device of claim 8 wherein if the communication  
2 mode is idle, the one or more of the second group of heterogeneous computational units are  
3 reconfigurable to implement one or more of the plurality of operating modes other than the  
4 communication mode.

1           14.     The communication device of claim 8 wherein if a third operating  
2 mode is to be implemented, one or more of the first group of heterogeneous computational  
3 units and/or the one or more of the second group of heterogeneous computational units are  
4 reconfigurable to implement the third operating mode.

1           15.     A communication device comprising:  
2           a plurality of heterogeneous computational elements, the plurality of  
3 heterogeneous computational elements including a first computational element and a second  
4 computational element, the first computational element having a first fixed architecture of a  
5 plurality of fixed architecture and the second computational element having a second fixed  
6 architecture of the plurality of fixed architectures, the first fixed architecture being different  
7 than the second fixed architecture, and the plurality of fixed architectures including functions  
8 for memory, addition, multiplication, complex multiplication, subtraction, configuration,  
9 reconfiguration, control, input, output, and field programmability; and  
10           an interconnection network coupled to the plurality of heterogeneous  
11 computational elements, the interconnection network operative to configure the plurality of  
12 heterogeneous computational elements;  
13           wherein a first group of heterogeneous computational elements is  
14 reconfigurable to form a first functional unit to implement a system acquisition function;

15 wherein a second group of heterogeneous computational elements is  
16 reconfigurable to form a second functional unit to implement a communication function; and  
17 wherein if the communication function is idle, one or more of the second  
18 group of heterogeneous computational elements are reconfigurable by the interconnection  
19 network to implement the system acquisition function.

1 16. The communication device of claim 15 wherein the first functional unit  
2 is a searcher.

1 17. The communication device of claim 15 wherein the communication  
2 device is a cellular phone, a Bluetooth communication device or a 802.11 communication  
3 device.

1 18. The communication device of claim 15 wherein if the communication  
2 function is idle, the one or more of the second group of heterogeneous computational  
3 elements are reconfigurable to implement the system acquisition function by forming one or  
4 more additional instances of the first functional unit.

1 19. The communication device of claim 15 wherein if the communication  
2 function is idle, one or more of the first group of heterogeneous computational elements and  
3 the one or more of the second group of heterogeneous computational elements are  
4 reconfigurable to form a single functional unit to implement the system acquisition function.

1 20. The communication device of claim 15 wherein if the communication  
2 function is idle, the one or more of the second group of heterogeneous computational  
3 elements are reconfigurable by the interconnection network to implement one or more of the  
4 plurality of functions other than the communication function.

1 21. The communication device of claim 15 wherein if a third function is to  
2 be implemented, one or more of the first group of heterogeneous computational elements  
3 and/or the one or more of the second group of heterogeneous computational elements are  
4 reconfigurable by the interconnection network to implement the third function.

1 22. A communication device comprising:  
2 a plurality of heterogeneous computational elements, the plurality of  
3 heterogeneous computational elements including a first computational element and a second

4 computational element, the first computational element having a first fixed architecture and  
5 the second computational element having a second fixed architecture, the first fixed  
6 architecture being different than the second fixed architecture; and  
7 an interconnection network coupled to the plurality of heterogeneous  
8 computational elements, the interconnection network operative to configure a first group of  
9 heterogeneous computational elements to form a first functional unit for a first functional  
10 mode of a plurality of functional modes, in response to first configuration information, and  
11 the interconnection network further operative to reconfigure a second group of heterogeneous  
12 computational elements to form a second functional unit for a second functional mode of the  
13 plurality of functional modes, in response to second configuration information, the first  
14 functional mode being different than the second functional mode, and the plurality of  
15 functional modes including system acquisition operations, linear algorithmic operations, non-  
16 linear algorithmic operations, finite state machine operations, memory operations, and bit-  
17 level manipulations;

18 wherein if the second functional mode is idle, one or more of the second group  
19 of heterogeneous computational units are reconfigurable to implement the first functional  
20 mode.

21 23. The communication device of claim 22 wherein the first functional  
22 mode is the system acquisition operations and the first functional unit is a searcher.

23 24. The communication device of claim 22 wherein the communication  
24 device is a cellular phone, a Bluetooth communication device or a 802.11 communication  
25 device.

26 25. The communication device of claim 22 wherein if the second  
27 functional mode is idle, the one or more of the second group of heterogeneous computational  
28 elements are reconfigurable to implement the first functional mode by forming one or more  
29 additional instances of the first functional unit.

30 26. The communication device of claim 22 wherein if the second  
31 functional mode is idle, one or more of the first group of heterogeneous computational  
32 elements and the one or more of the second group of heterogeneous computational elements  
33 are reconfigurable to form a single functional unit to implement the first functional mode.

1                   27.     The communication device of claim 22 wherein if the second  
2 functional mode is idle, the one or more of the second group of heterogeneous computational  
3 elements are reconfigurable by the interconnection network to implement one or more of the  
4 plurality of functional modes other than the second functional mode.

1                   28.     The communication device of claim 22 wherein if a third functional  
2 mode is to be implemented, one or more of the first group of heterogeneous computational  
3 elements and/or the one or more of the second group of heterogeneous computational  
4 elements are reconfigurable by the interconnection network to implement the third functional  
5 mode.

1                   29.     A method for allocating hardware resources within a communication  
2 device, the hardware resources including a plurality of heterogeneous computational  
3 elements, the method comprising:  
4                   in response to first configuration information, configuring a first group of  
5 heterogeneous computational elements to form a first functional unit to implement a system  
6 acquisition function and configuring a second group of heterogeneous computational  
7 elements to form a second functional unit to implement a communication function; and  
8                   in response to second configuration information, reconfiguring one or more of  
9 the second group of heterogeneous computational elements to implement the system  
10 acquisition function.

1                   30.     The method of claim 29 wherein the first functional unit is a searcher.

1                   31.     The method of claim 29 wherein the communication device is a  
2 cellular phone, a Bluetooth communication device or a 802.11 communication device.

1                   32.     The method of claim 29 wherein the second configuration information  
2 is generated when the communication function is idle.

1                   33.     The method of claim 29 wherein in response to the second  
2 configuration information, the one or more of the second group of heterogeneous  
3 computational elements are reconfigured to form one or more additional instances of the first  
4 functional unit to implement the system acquisition function.

1                   34.     The method of claim 29 wherein in response to the second  
2 configuration information, one or more of the first group of heterogeneous computational  
3 elements and the one or more of the second group of heterogeneous computational elements  
4 are reconfigured to form a single functional unit to implement the system acquisition  
5 function.

1                   35.     The method of claim 29 further comprising:  
2 in response to third configuration information, reconfiguring one or more of  
3 the first group of heterogeneous computational elements and/or the one or more of the second  
4 group of heterogeneous computational elements to implement a third function.

1                   36.     A method for allocating hardware resources within a communication  
2 device, the hardware resources including a plurality of heterogeneous computational  
3 elements, the method comprising:  
4 in response to first configuration information, configuring a first group of  
5 heterogeneous computational elements to implement a system acquisition function; and  
6 in response to second configuration information, reconfiguring one or more of  
7 the first group of heterogeneous computational elements to implement a communication  
8 function.

1                   37.     The method of claim 36 wherein in response to the first configuration  
2 information, the first group of heterogeneous computational elements is configured to form  
3 one or more functional units to implement the system acquisition function.

1                   38.     The method of claim 37 wherein each of the one or more functional  
2 units is a searcher.

1                   39.     The method of claim 36 wherein the first configuration information is  
2 generated when the system acquisition function is needed and the second configuration  
3 information is generated when the system acquisition function is completed.

1                   40.     The method of claim 29 wherein the communication device is a  
2 cellular phone, a Bluetooth communication device or a 802.11 communication device.